CUMULATIVE INDEX 1993

Volume 11

March	EMBOLISM II, pages 1–204
June	ADVANCES IN THE USE OF MUSCLE RELAXANTS, pages 205–452
September	ANESTHESIA FOR OTOLARYNGOLOGIC AND HEAD AND NECK SURGERY, pages 453–706
December	NEW DRUGS IN ANESTHESIA: PART I, pages 707–869

Note: Page numbers of issues and article titles are in **boldface** type.

Acetazolamide, for arterial embolism, 132
Acetylcholine, chemical structure of, 221, 285
  compared with depolarizing and nondepolarizing agents, 220
  half-life of, 229
  and muscle contracture, 415
Acetylcholine receptors, **205–218**
  background, 205–206
  ligand-gated receptors, 206
  muscle receptors, 206–213
  neural receptors, 213–215
Acetylcholinesterase, anticholinesterase agents and, 238–239
  half-life of, 229
  sites of action, 239
Acetylsalicylic acid, 822. See also *Nonsteroidal anti-inflammatory drugs.*
Acid mucopolysaccharide (AMP), and diagnosis of amniotic fluid embolism, 62
Acidosis, in stored blood, 626
Acoustic neuroma, 552
Adductor pollicis muscle, low-current stimulation, 372–373
  monitoring of muscle relaxant response, 330–331, 335, 336, 363
  response to muscle relaxants, 744–747
  summary of twitch monitoring, 375
Adenoidectomy, hemorrhage following, 645–646
Adenosine, for induction of hypotension, 605
Adenotonsillectomy, nitrous oxide and, 565
Adult respiratory distress syndrome (ARDS), association with amniotic fluid embolism, 65, 68, 73
  and infectious embolism, 91
  similarity to symptoms of fat embolism syndrome, 30, 34, 47
  and tumor embolism, 86
Adverse effects of neuromuscular blocking agents. See *Complications of neuromuscular blocking agents.*
Air embolism, **1–24**
  distinguishing from amniotic fluid embolism, 60
  history of, 1–3
  incidence of, 7–8, 9
  monitoring and diagnosis of, 9–16
    airway pressure, 15
    arterial blood pressure, 15
    central venous catheter, 13–15
    central venous pressure, 12–13
    electrocardiogram, 15
    end expiratory CO_2, 12
    precordial Doppler, 9–11
    pulmonary artery pressure, 12
    transcranial Doppler, 15–16
    transesophageal Doppler, 11
    transesophageal echocardiography, 12
  physiopathology of, 3–8
  signs and symptoms of, 8–9, 18
  treatment of, 16–17
  venous gas embolism, caused by environmental pressure changes, 145–146

Airway, difficult, in head and neck tumor surgery, **475–503**
basic forms of difficult airway, 476
iatrogenic, 494–503
epiglottic tumor, 500–502
glomus tumor, 498–500
postoperative airway edema, 502–503
recurrent vocal cord papillomata, 494–496
subglottic hemangioma, 496–498
methods of recognizing difficult airway, 477–479
recognized, in emergent settings, 485–489
angioneurotic edema, 487–489
obstructed tracheostomy stoma, 486–487
piriform fossa tumor, 485–486
recognized, in nonemergent settings, 479–485
awake intubation in, 479–480
goiter, 481–483
right submandibular mass, 483–485
supraglottic tumor of piriform sinus, 480–481
unrecognized, in emergent settings, 491–494
in nonemergent settings, 489–491
preoperative evaluation of, **453–471**
diagnostic modalities in, direct laryngoscopy, 466
fiberoptic bronchoscopy, 469
indirect mirror examination, 466
magnetic resonance imaging and computed tomography, 469
nasopharyngoscopy, 466
pulmonary function testing, 468–469, 470
radiographs, 466–468
videolaryngoscopy, 471
difficult tracheal intubation, physical indicators of, 458–465
airway obstruction evaluation, 462–464
bivariate prediction of difficulty, 461
craniofacial syndromes and, 465
direct laryngoscopy grading classification, 459
facial and laryngeal trauma, 464–465
history of previous radiation therapy, 455–456
Mallampati airway classification scheme, 458–459
mandibular space measurement, 461–462
neck extension, 460–461
in pediatric patients, 463–464
pharyngeal or laryngeal cancer, 457–458
previous history of, 454–455
temporomandibular joint dysfunction, 462
general considerations, 454–458
dental examination, 455
difficult mask fit, 456
history of previous neck radiotherapy, 455–456
history of previous tracheal intubation difficulties, 454–455
neck masses and previous neck surgery, 456–457
tracheotomized patients, 456
voice quality, 456
in take-back patients, **651–676**
Combitube technique, 672–673
equipment preparation for, 653
laryngeal mask airway for, 670–671
maintaining oxygenation in, 675
patient challenges in, 653
percutaneous oxygenation in, 673–675
physician education and, 653
protection of cardiovascular system and, 656
selection of basic airway management for, 653–656
spontaneous pulmonary ventilation in, 655
tracheal extubation of, 656, 676
tracheal intubation of, 656–669
direct laryngeal visualization and, 657–663
fluoroscopic control of, 667
indirect laryngeal visualization and, 663–666
light wand guidance for, 666–667
passing of endotracheal tube into trachea, 669
retrograde techniques, 667–669
Airway edema, indirect laryngeal visualization of, 666
in postanesthesia recovery care, 686
postoperative, management of, 502–503
Airway fires. See under *Laser surgery.*
Airway muscles, response to muscle relaxants, 744–747
Albuterol, for reactions to contrast media, 186
Alcohol infusion, and fat embolism, 45–46
Alcuronium, combined with other neuromuscular blocking agents, 431–432
effect of succinylcholine on, 427
and precurarization, 430
reversal by antagonists, 395, 398
Alfentanil, combined with propofol, 840
in ear surgery, 554

in therapeutic embolization procedures, 177, 178
Altepase. See Tissue plasminogen activator (TPA).
Ambulatory otorhinolaryngologic surgery, **525–542**
choice of anesthesia in, 528–532
general anesthesia, 528–529
intravenous anesthesia, 529–530
muscle relaxants, 531–532
volatile inhalation anesthetics, 530–531
control of nausea and vomiting in, 534–538
anesthetic agents for, 535–536
anesthetic techniques in, 535
pain and, 536
preoperative history and, 536
prophylaxis for, 536–538
surgical procedures and, 536
ENT procedures commonly performed in, 526–527
pain management for, 532–534
intravenous opioids in, 532–534
patient selection for, 527–528
tonsillectomy, 539–540
upper respiratory infections and, 540–542
epsilon-Aminocaproic acid, in conjunction with therapeutic embolization procedures, 172
Aminoglycosides, and neuromuscular blocking agents, 436
for treatment of infectious emboli, 89, 90
Aminophylline, for reactions to contrast media, 186
4-Aminopyridine, chemical structure of, 240
interaction with neostigmine and edrophonium, 239
mechanism of action, 245–246
Amniotic fluid embolism, **55–78**
cause and pathogenesis of, 64–68
clinical presentation of, 59
differential diagnosis of, 59–63
air embolism, 60
cardiac failure, 61
cerebrovascular accident, 61–63
eclampsia, 61
hemorrhage, 59–60
pulmonary aspiration, 61
pulmonary thromboembolism, 60
toxic reaction to local anesthetic, 60–61
epidemiology of, 57–59
mortality, 57
predisposing factors, 57–59
history of, 56–57
management of, 68–72
delivery of fetus, 71
fluid therapy, 70–71
intra-aortic balloon pump, 72
laboratory evaluation, 72
monitoring, 71
oxygenation, 69
pharmacologic therapy, 69–70
radiologic evaluation, 72
ventilation and airway protection, 69
Amyotrophic lateral sclerosis, and neuromuscular blocking agents, 413–414
Anaerobic organisms, and infectious emboli, 88–89
Anaphylaxis, with propofol, 833
with succinylcholine, 318
Aneurysms, intracranial, rebleeding vs. surgical risks, 173–174
therapeutic embolization of, 165–168
Angiography. See also *Therapeutic embolization of neurovascular lesions.*
for diagnosis of arterial embolism, 127, 128
pulmonary, in amniotic fluid embolism, 72
in tumor embolism, 81–82
transluminal, therapeutic embolization of neurovascular lesions, 169–171
Angioneurotic edema, airway management in, 487–489
Anti-inflammatory drugs. See *Nonsteroidal anti-inflammatory drugs.*
Antibiotics, and neuromuscular blocking agents, 435–436
for treatment of infectious emboli, 89–90, 92
Anticholinesterase agents, 237–245
for antagonism of neuromuscular blocking agents, 260–262, 313, 756, 758, 759
chinothylinum, 245
edrophonium, 243–244, 261, 395–401, 756, 758
galanthamine, 240, 245
mode of action, 238–240
neostigmine, 240–242
antagonism of neuromuscular blocking agents, benzylisoquinolinium compounds, 261, 264
effectiveness of, 395–401, 429
long-acting agents, 755
mivacurium, 758
recommended dosage, 760
succinylcholine, 313
chemical structure of, 240
edrophonium vs., 244
mode of action, 238–240
pharmacokinetics of, 241–242
side effects and drug interactions of, 244–245, 402
pyridostigmine, 238–240, 242–243

Anticholinesterase agents *(Continued)*
side effects and drug interactions, 244–245
Anticoagulants, for arterial embolism, 131–135, 152
for venous gas embolism, 152
Antiepileptic agents, and neuromuscular blocking agents, 436–437
Aortoarterial emboli, 108–112, 113
atheromatous plaques, 108–109
location of plaques, 111
mural thrombi, 109–110
perioperative embolization of, 111
transesophageal echocardiography of, 111–112, 113
trauma and, 110–111
Apnea, benzodiazepine-induced, reversal of, 805
caused by propofol, 834
Apneic technique, intentional, 639
Aprotinin, and treatment of fat embolism, 46
Arachidonic acid metabolism, and amniotic fluid embolism, 66–68, 73
ARDS. See *Adult respiratory distress syndrome (ARDS).*
Arduan. See *Pipecuronium.*
Argon laser, 577
Arterial embolism, **103–141**
arterial gas embolism, caused by environmental pressure changes, 144–145
diagnosis of, 125–127
angiography, 127, 128
etiology of acute arterial ischemia, 125
thrombosis vs. embolism, 126–127
emboli to other organs, 118–125
cerebral embolism, 120–123
coronary embolism, 118–119
mesenteric emboli, 123–125
renal artery embolism, 119–120
management of, 127–135
anticoagulation and thrombolysis, 131–135
embolectomy, 130–131
heparin, 127, 129
outcome of embolectomy, 135
reperfusion syndrome, 131
viability of limbs, 129–130
peripheral emboli, 112–118
anatomic locations of, 116
atheroembolism, 116–117
diseases with symptoms similar to cholesterol embolism, 115
level and location of, 114, 116
saddle aortic emboli, 117–118
symptoms of, 112, 114
presentation and symptoms of, 112–125
sources and causes of, 103–112, 113
aortoarterial emboli, 108–112, 113
atrial emboli, 106–107
cardiac sources, 104–106
ventricular emboli, 107–108
tumor emboli as source of, 82–83
cardiac sources, 82–83
extracardiac sources, 83
sites of distal tumor embolism, 83
Arterial ischemia, and arterial embolism, 125–126
Arteriovenous fistulas, therapeutic embolization of, 163–164
Arteriovenous malformations, therapeutic embolization of, brain arteriovenous malformations, 164–165, 166, 167, 172–173
dural arteriovenous malformations, 162–163
spinal arteriovenous malformations and tumors, 168–169
Aspirin, for arterial embolism, 132
injectable, 822
for prophylaxis of fat embolism, 43
Atheroembolism, 117–118
atheromatous plaques as aortoarterial emboli, 108–109
differentiation of cholesterol emboli from other diseases, 114, 115
etiology of, 117
location of plaques, 111
transesophageal echocardiography of, 112
trauma as cause of, 110–111
Atracurium, 269–270. See also *Benzylisoquinolinium neuromuscular blocking drugs.*
in ambulatory otorhinolaryngologic surgery, 532
basic pharmacology of, 269–270
breakdown and elimination of, 257, 262, 348–349, 350
chemical structure of, 221, 269
combined with other neuromuscular blocking agents, 431–432
comparative metabolism of, 738–739
comparative pharmacokinetics of, 731, 741, 742
for decreasing myalgias, 430
duration of, 234, 326, 329, 403
effect of succinylcholine on, 428
in elderly patients, 764–765
histamine release effect of, 326, 329, 347
Hofmann elimination of, 252–253, 348
infusion rate, 333–334
intensive care use of, 346, 348–349, 353
interaction with other drugs, 432–433, 435, 437, 438, 439
in kidney failure, 769

laudanosine as breakdown product of, 348–350, 353
in liver disease, 768
onset time, 748
peak blocking effect of, 745, 746
in pediatric patients, 762
priming principle and, 430–431
reversal by antagonists, 395–400, 755, 756
in therapeutic embolization procedures, 178
twitch monitoring of, 369–370
Atrial emboli, 106–107
Atrial fibrillation, associated with arterial embolization, 105–106
Atropine, antimuscarinic effect of, 245, 402
in therapeutic embolization procedures, 176
Automated infusion of anesthesia. See *Pharmacokinetics and pharmacodynamics of continuous infusion.*
Autonomic blocking properties of benzylisoquinolinium compounds, 254–255, 256–257

Bambuterol, succinylcholine and, 312
Barbiturates, for ruptured intracranial aneurysm, 170
Barometric pressure changes and embolism. See *Environmental pressure changes as cause of embolism.*
Bends. See *Environmental pressure changes as cause of embolism.*
Benzodiazepine antagonist. See *Flumazenil.*
Benzodiazepine receptors, association with GABA receptors, 799–800
ligands active at, 800–801
Benzodiazepines, interaction with neurotransmitter system, 801
overdose from, treatment with flumazenil, 808–809
reciprocal dose-dependent effects of benzodiazepines and flumazenil, 801–802
in therapeutic embolization procedures, 176, 177
in tumor embolism, 84
withdrawal from, flumazenil and, 811
Benzylisoquinolinium neuromuscular blocking drugs, **251–281**
antagonism by anticholinesterases, 260–262
autonomic effects of, 254–255, 256–257
comparative metabolism of, 738–740
atracurium, 738–739
doxacurium, 739
mivacurium, 739–740
enzymatic antagonism by pseudocholinesterases, 262, 264
general pharmacology of, 253–264
histamine release by, 254, 255, 257, 258–260
history and background of, 251–253
intermediate duration, 269–272
atracurium, 269–270
BW A444U, 270–272
long-acting drugs, 265–269
doxacurium, 267–269
metocurine, 267, 268
d-tubocurarine, 265, 267
metabolism, elimination, and pharmacokinetics of, 257, 260, 261, 263
potency of, 253–254
short-acting drugs, 272–277
BW 785U, 272–273
mivacurium, 273–277
structure-activity relationships, 733, 735–737
doxacurium, 733, 735
mivacurium, 735–737
Bleeding. See *Hemorrhage.*
Bleomycin, and tumor embolism, 86
Blood, cardiac output and, 617
hemodynamics of, 616–619
oxygen-carrying capacity of, 616–619
oxyhemoglobin dissociation curve and, 618
red cell volume of, 617
Blood flow, in induced hypotension, cerebral, 598–601
vascular, 601–602
Blood gas evaluation, in amniotic fluid embolism, 72
Blood pressure, arterial, and diagnosis of air embolism, 15
decreased, caused by propofol, 833, 834–835
Blood transfusion, massive, **615–635**. See also *Hemorrhage.*
acidosis and, 626
blood components, 620–624
cryoprecipitate, 624
packed red blood cells, 620–621
plasma, 621–623
platelets, 623–624
blood volume and, 616
citrate toxicity and, 626–627
coadministration of drugs with, 630
coagulopathies following, 631–633
collection and storage of blood, 619–620
conservation techniques, 633–635
autologous salvage in, 633–634
normovolemic hemodilution and, 634–635
crystalloid vs. colloid replacement, 616–617

Blood transfusion *(Continued)*
dilution of blood, 625
2,3-diphosphoglycerate depletion and, 629
disease transmission in, 627–628
tests for, 628
graft-versus-host disease and, 630–631
hemoglobin saturation and, 618
hyperkalemia and, 627
hypothermia and, 625–626
matching procedure in, 624–625
microembolization and, 630
monitoring of adequate oxygen delivery, 619
transfusion reactions in, 628–629, 630
Blood volume, and infectious embolism, 91
and therapy of fat embolism, 46
Blue toe syndrome, 117
Bolus dosing. See *Pharmacokinetics and pharmacodynamics of continuous infusion.*
Bone fractures, and fat embolism, 26–27, 39, 41–42
Brain, arteriovenous malformations of, therapeutic embolization of, 164–165, 166, 167, 172–173
effect of neostigmine, 402
intracranial pressure and, after flumazenil administration, 805–806
as complication of succinylcholine, 316
Bullard laryngoscope-aided tracheal intubation, 520
Bupivacaine, and neuromuscular blocking agents, 439
Burns, and neuromuscular blocking agents, 420–421
Butorphanol, in therapeutic embolization procedures, 177
BW A444U, 270–272
BW 785U, 272–273

Calcium, chelation by citrate, 626–627
Calcium channel blockers, neuromuscular blocking agents and, 438–439
Captopril, for induction of hypotension, 606
Carbon dioxide laser, 575–577, 697
Cardiac surgery, avoidance of neuromuscular block reversal agents after, 403
and use of steroidal muscle relaxants, 299
Cardiovascular complications, of induced hypotension, 601
Cardiovascular dysfunction, in amniotic fluid embolism, 65–66
Cardiovascular effects of anesthetic agents, desflurane, 712–718
flumazenil, 804
muscle relaxants, adverse effects of reversal agents, 402
atracurium, 270, 762
benzylisoquinolinium compounds, 254, 255, 257, 258, 259
BW A444U, 271, 272
BW 785U, 273
doxacurium, 269
metocurine, 267
mivacurium, 276–277, 760
pipecuronium, 732
succinylcholine, 317, 326–327
d-tubocurarine, 265, 267
vecuronium, 434
propofol, 833, 834–835
sevoflurane, 724, 725
Catheterization, in amniotic fluid embolism, 56
for diagnosis of air embolism, 13–15
in therapeutic embolization procedures, 159–160
Catheters and wires, as foreign body emboli, 95, 98
Central nervous system effects, of desflurane, 718–719
of propofol, 835–836
Central venous catheter, for diagnosis of air embolism, 13–15
Central venous pressure, and air embolism, 4, 12–13
Cephalosporins, for treatment of infectious emboli, 89, 90
Cerebral blood flow, in induced hypotension, 598–601
Cerebral embolism, 120–123
Cerebral palsy, and neuromuscular blocking agents, 412
Cerebrovascular accident, atheromatous plaques as cause of, 111
distinguishing from amniotic fluid embolism, 61–63
following otolaryngologic surgery, 642
Chemoreceptor trigger zone (CTZ), 556
Chemotherapy, and tumor embolism, 85–86
Chest radiography, in fat embolism syndrome, 38–39
in tumor embolism, 81
Children. See *Infants and children.*
Chinothylinum, 245
Chloral hydrate, in therapeutic embolization procedures, 176
Cholesterol embolism. See *Atheroembolism.*
Cimetidine, and neuromuscular blocking agents, 312, 437–438
protection against gastric injury from NSAIDs, 823
Cis-platinum, and tumor embolism, 86

Citrate toxicity, in massive blood transfusion, 626–627
Clinical tests of recovery from neuromuscular blocking agents, **379–389**. See also *Twitch monitoring of neuromuscular blockade.*
airway protection, 385–386
muscles of airway protection, 381–382
muscles of ventilation, 379–381
tests, 382–385, 386–388
associated with ventilation, 383
maximum inspiratory pressure, 384–385
tidal volume and minute ventilation, 383
vital capacity, 383–384
Clonidine, for induction of hypotension, 606, 607
Coagulopathies, after blood transfusion, 631–633
tests for clotting, 631–632
thrombelastography and, 633, 634
Cocaine, in ambulatory otorhinolaryngologic surgery, 534
in nasal and sinus surgery, 694
Colistin, interaction with muscle relaxants, 92
Combined effects of neuromuscular blocking agents. See *Interaction of neuromuscular blocking agents.*
Combitube airway, in take-back patients, 672–673
Complications of neuromuscular blocking agents, anticholinesterase agents, 244–245
in intensive care settings, 354–355
interaction with diseases, **409–425**
amyotrophic lateral sclerosis, 413–414
burns, 420–421
cerebral palsy, 412
diffuse intracranial lesions, 412
hemiplegia, 410–411
immobilization atrophy, 421
infections, 420
intracranial lesions, 410–412
multiple sclerosis, 412
muscular denervation, 415–416
muscular dystrophies, 419–420
muscular lesions, 418–420
myasthenia gravis, 416–417
myasthenic syndrome, 417
myotonias, 418–419
neuromuscular junction lesions, 416–417
paraplegia, 413
Parkinson's disease, 412
peripheral nerve lesions, 414–416
peripheral neuropathies, 414–415
poliomyelitis, 414
polymyositis, 420
regional curare test, 409–410
spinal cord lesions, 413–414
interaction with other agents, **427–444**
anesthetic agents, 432–435
antibiotics, 435–436
antiepileptic agents, 436–437
bupivacaine, 439
calcium and calcium channel blockers, 438–439
corticosteroids, 439
disopyramide, 439
histamine antagonists, 437–438
nondepolarizing neuromuscular blockers, 430–432
other neuromuscular blockers, 427–432
succinylcholine, 427–430
reversal agents, 401–402
succinylcholine, 315–319, 326–327
anaphylaxis, 318
cardiovascular effects, 317, 326–327
fasciculations, 315
hyperkalemia, 315–316, 410, 411, 412–413, 414–415
intracranial pressure, 316
intragastric pressure, 317
intraocular pressure, 316–317
malignant hyperthermia, 318, 420
masseter spasm, 318
myalgia, 315
Computed tomography (CT), in fat embolism syndrome, 39
Cor pulmonale, and fat embolism, 30, 35, 46
Coronary artery embolism, 118–119
Corticosteroids, for arterial or venous gas embolism, 152
and neuromuscular blocking agents, 439
for prophylaxis of fat embolism, 43, 47
for reactions to contrast media, 187
Coumadin, for arterial embolism, 132
Cranial nerves, preservation of, in head and neck surgery, 696
Craniofacial syndromes, associated with difficult tracheal intubation, 465
Cricothyrotomy, 521, 673–675
Cryoprecipitate, in blood transfusion, 624
Curare, as cause of hypotension, 325
for convulsive therapy, 380
recovery time, 335
regional curare test, 409–410
in therapeutic embolization procedures, 178
Curare-like drugs. See *Benzylisoquinolinium neuromuscular blocking drugs.*
Cytomegalovirus, transmitted in blood, 628
Cytoxan, and tumor embolism, 86

Daunorubicin, and tumor embolism, 86

DBS. See *Double-burst stimulus (DBS).*
Dental examination, in preoperative airway evaluation, 455
Depolarizing neuromuscular blocking agents, 229–232
  defined, 220
  phase II block, 331–332
  succinylcholine metabolism, 230–231
Desflurane, 708–722
  in ambulatory otorhinolaryngologic surgery, 530
  animal studies of, 721
  cardiovascular effects of, 712–718
  central nervous system effects of, 718–719
  characteristics of ideal anesthetic agents, 708
  dosage of, 710
  in ear surgery, 555
  emergence from, 719–721
  hypotensive effect of, 721
  isoflurane vs., 714–715, 721
  neuromuscular function of, 719
  nitrous oxide vs., 709
  nitrous oxide with, 710, 713, 714–715
  in pediatric patients, 721
  pharmacokinetics of, 709–710
  physical characteristics of, 707
  release of fluoride by, 711
  respiratory effects of, 712
  stability of, 711
  structure of, 708
  sufentanil vs., 713–714
  toxicity of, 711–712
Dextran 40, for prophylaxis of fat embolism, 43
Diaphragm, and intraoperative monitoring of muscle relaxants, 331–332
  measurement of blockade of diaphragm, 367–368, 369
  resistance to nondepolarizing muscle relaxants, 379–381
Diazepam, in infectious embolism, 93
  in therapeutic embolization procedures, 177
  in tumor embolism, 84–85
DIC. See *Disseminated intravascular coagulation (DIC).*
Diclofenac, 821
  effectiveness of, 821
  side effects of, 821
Difficult airway, management of. See *Airway, difficult.*
Diltiazem, and neuromuscular blocking agents, 438
  in tumor embolism, 85
Diphenhydramine, for reactions to contrast media, 186
  in therapeutic embolization procedures, 176
2,3-Diphosphoglycerate, depletion of, in stored blood, 629–630
  oxyhemoglobin saturation and, 618
Disopyramide, and neuromuscular blocking agents, 439
Disseminated intravascular coagulation (DIC), in amniotic fluid embolism, 66, 71
  triggered by fat embolism, 31
Dobutamine, for amniotic fluid embolism, 69, 70
  for ruptured intracranial aneurysm, 170
  in tumor embolism, 85
Dopamine, for amniotic fluid embolism, 69, 70
  in infectious embolism, 91
Dopamine receptors, 350, 351
Doppler ultrasonography, of air embolisms, precordial Doppler, 9–11, 16
    transcranial Doppler, 15–16
    transesophageal Doppler, 11–12
  of fat embolisms, 44
Double-burst stimulus (DBS), and monitoring of muscle relaxants, 372, 393–394, 403
Doxacurium, 267–269
  chemical structure of, 735
  comparative metabolism of, 739
  comparative pharmacokinetics of, 731, 740–741
  in elderly patients, 763–764
  interaction with other drugs, 437
  in kidney failure, 771
  in liver disease, 768
  onset time, 748, 751–753
  in pediatric patients, 763
  potency of, 733, 751–753
  recovery time, 335
  reversal by antagonists, 400, 755
  structure-activity relationships, 733, 735
Doxorubicin, and tumor embolism, 86
Droperidol, for prevention of nausea and vomiting, 537, 688
  in therapeutic embolization procedures, 176, 177, 179
Drug delivery techniques. See *Pharmacokinetics and pharmacodynamics of continuous infusion.*
Drug interactions. See *Interaction of neuromuscular blocking agents.*
Dural arteriovenous malformations, therapeutic embolization of, 162–163

Ear, anatomy and physiology of, 547–548

external ear, 547
inner ear and labyrinth, 548–550
middle ear, 547–548
general pathology of, 550
Ear surgery, anesthesia for, **547–557**
inhaled halogenated agents, 554–555
intravenous induction agents, 554
intravenous infusions, 554
nondepolarizing muscle relaxants and antagonism, 555–556
opioids for general anesthesia, 555
outpatient vs. inpatient selection, 552
overview of general anesthesia, 553
premedication in, 553
techniques in, 552–553
complications of, 556
of external ear, 550
of inner ear, 552
of middle ear, 551
nitrous oxide anesthesia in, **559–570**
decreased middle ear pressure and, 569
effects on hearing, 568
increased middle ear pressure and, 562–566
summary of complications, 570
in tympanoplasty, 566–567
uptake in body air spaces, 559–562
Echocardiography, transesophageal, for diagnosis of air embolism, 12
for diagnosis of fat embolism, 44
identification of aortoarterial emboli, 111–112, 113
Eclampsia, and amniotic fluid embolism, 56, 61
Edrophonium, 243–244
antagonism of neuromuscular blocking agents, 261, 395–401, 756, 758
recommended dosage, 760
chemical structure, 240
interference with other anticholinesterase agents, 239
mode of action, 238–239
neostigmine vs., 244
pharmacokinetics, 243–244
side effects and drug interactions, 245, 402
train-of-four ratio and, 373, 374
Elderly, neuromuscular blocking agents in, 297–298, 401, 763–766
doxacurium and pipecuronium, 763–764
mivacurium, 765–766
rocuronium vs. atracurium and vecuronium, 764–765
propofol usage in, 832, 833
Electrocardiography, for air embolism, 15
for fat embolism syndrome, 39
Electroconvulsive therapy, propofol and, 836
Electromyogram (EMG), for measurement of muscle relaxant response, 362, 373, 393
Embolisms, air, **1–24**
history of, 1–3
monitoring and diagnosis of, 9–16
physiopathology of, 3–8
signs and symptoms of, 8–9
treatment of, 16–17
amniotic fluid, **55–78**
cause and pathogenesis of, 64–68
clinical presentation of, 59
diagnosis of, 59–63
epidemiology of, 57–59
history of, 56–57
management of, 68–72
arterial, **103–141**
diagnosis of, 125–127
management of, 127–135
presentation and symptoms of, 112–125
sources and causes of, 103–112, 113
caused by sudden environmental pressure changes, **143–156**
arterial gas embolism, 144–145
treatment of, 146–153
venous gas embolism, 145–146
fat, **25–54**
clinical presentations and symptoms of, 32–36
diagnosis of, 39–41
history of, 25–26
incidence and etiology of, 26–29
laboratory and other tests for, 36–39
pathophysiology of, 29–32
perioperative anesthetic considerations for, 44–45
prevention of, 41–43
prognosis for, 47–48
treatment of, 45–47
therapeutic embolization of neurovascular lesions, **157–195**
anesthesia for therapeutic angioembolization, 175–182
arteriovenous fistulas, 163–164
arteriovenous malformations, 162–163, 164–165, 166, 167, 168–169, 172–173
complications of angioembolization procedures, 182–187
interventional neuroradiologic procedures, 158–175
intracranial aneurysms, 165–168, 173–174
risks of, 174–175
thrombolytic therapy for, 171–172
transluminal angioplasty, 169–171

Embolisms *(Continued)*
tumors, 161–162
tumor, infectious, and foreign body emboli, **79–101**
foreign body emboli, 93–99
infectious emboli, 86–93
tumor embolism, 79–86
Encephalopathy, hepatic, flumazenil for, 810
End expiratory carbon dioxide, for detection of fat embolism, 44
for diagnosis of air embolism, 12, 16
Endocarditis, and infectious emboli, 86, 87, 106–107
Endoscopic procedures, safety considerations in, 696–698
Endotracheal tubes for laser surgery. See under *Laser surgery.*
Enflurane, in ambulatory otorhinolaryngologic surgery, 530
for induction of hypotension, 604
physical characteristics of, 707
potentiation of atracurium, 762
in therapeutic embolization procedures, 180
Environmental pressure changes as cause of embolism, **143–156**
arterial gas embolism, 144–145
treatment of, 146–153
adjunctive therapy, 151–153
hyperbaric oxygen, 147–151
outcome following treatment, 150
venous gas embolism, 145–146
Ephedrine, for prevention of nausea and vomiting, 538
Epiglottic tumor, surgery of, airway management in, 500–502
Epilepsy, flumazenil for, 810
Epinephrine, for reactions to contrast media, 186
Esmolol, for induction of hypotension, 605, 607
in therapeutic embolization procedures, 182
Etomidate, propofol vs., 836, 839
in therapeutic embolization procedures, 178
in tumor embolism, 85
Evoked potentials, effect of propofol on, 836
somatosensory, for monitoring of therapeutic embolization, 169, 180–181
Extrajunctional receptors, 208, 210–213, 411
Extremities, categories of limb ischemia, 128, 129
embolectomy, 130–131, 135
reperfusion syndrome, 131
viability after embolism, 129–130

Eyes, protecting, during laser surgery, 578–579
during otolaryngologic surgery, 643

Fat embolism, **25–54**
clinical presentations and symptoms of, 32–36
defined, 25
differential diagnosis of, 39–41
etiology of, 26–29
incidence of, 26
laboratory and other tests for, 36–39
pathophysiology of, 29–32
perioperative anesthetic considerations for, 44–45
prevention of, 41–43
prognosis for, 47–48
treatment of, 45–47
Fenoldopam, for induction of hypotension, 605
Fentanyl, combined with desflurane, 711
combined with propofol, 840
in infectious embolism, 93
in therapeutic embolization procedures, 177, 179, 180
Fiberoptic-aided tracheal intubation, in maxillofacial/mandibular trauma, 519–520
Fiberoptic bronchoscopy, in preoperative airway evaluation, 469
using bronchoscope as jet stylet, 502
Fluid therapy, in amniotic fluid embolism, 70–71
for arterial or venous gas embolism, 152
in infectious embolism, 91
in tumor embolism, 85
Flumazenil, **799–814**
clinical experience with, anesthetic effect of, 808–806
for benzodiazepine overdose, 808
concerns with, 810–812
benzodiazepine withdrawal and, 811
partial response to, 810
resedation after, 812, 837
seizures from, 811
GABA-benzodiazepine receptor-chloride channel complex and, 799–801
history of, 799
mechanism of action, 799–802
minor side effects of, 809–810
organ effects of, 804–806
cardiovascular, 804
respiratory, 804–805
other applications for, 810
physiochemical properties of, 802–804
average pharmacokinetic data for, 803
chemical structure of, 802

radiolabeled uptake studies of, 803
potential uses, 812
reciprocal dose-dependent effects of benzodiazepines and flumazenil, 801–802
in therapeutic embolization procedures, 178
Flunarizine, and neuromuscular blocking agents, 438–439
Fluoride, released by desflurane, 711
released by sevoflurane, 724
Fluorocarbons, for arterial or venous gas embolism, 152–153
Foreign body emboli, **93–99**
anesthetic considerations, 98–99
catheters and wires, 95, 98
miscellaneous foreign bodies, 98
missile emboli, 94–95, 96–97
Fractures, and fat embolism, 26–27, 39, 41–42
Free fatty acids, role in fat embolism, 30–31

GABA, binding by propofol, 835
GABA-benzodiazepine receptor-chloride channel complex, and flumazenil, 799–801
Galanthamine, 240, 245
Gallamine, 221, 430, 731, 734, 747, 748
Gastric mucosal injury, from ketorolac, 819
protection for, against NSAIDs, 823
Gastrointestinal system, neostigmine and, 402
succinylcholine and, 317
Glomus tumor, surgery of, airway management in, 498–500
anesthetic technique and, 552
Glucose, for arterial embolism, 132
for prophylaxis of fat embolism, 43
Glycopyrrolate, antimuscarinic effect of, 245, 402
in therapeutic embolization procedures, 176
Goiter resection, airway management in, 481–483
Graft-versus-host disease, after blood transfusion, 630–631
Gram-negative organisms, and infectious emboli, 88
Gram-positive organisms, and infectious emboli, 87–88, 89

H_2 antagonists, 823
Halothane, in ambulatory otorhinolaryngologic surgery, 530
in ear surgery, 554
for induction of hypotension, 604, 606
physical characteristics of, 707
potentiation of mivacurium, 760
in therapeutic embolization procedures, 178, 179
Hand squeeze, for testing recovery from neuromuscular blocking agents, 386–387
Hazards in otolaryngologic surgery. See *Safety considerations in otolaryngologic surgery.*
Head and neck tumor surgery, difficult airway in, **475–503**
basic forms of difficult airway, 476
iatrogenic, 494–503
epiglottic tumor, 500–502
glomus tumor, 498–500
postoperative airway edema, 502–503
recurrent vocal cord papillomata, 494–496
subglottic hemangioma, 496–498
methods of recognizing difficult airway, 477–479
recognized, in emergent settings, 485–489
angioneurotic edema, 487–489
obstructed tracheostomy stoma, 486–487
piriform fossa tumor, 485–486
recognized, in nonemergent settings, 479–485
awake intubation in, 479–480
goiter, 481–483
right submandibular mass, 483–485
supraglottic tumor of piriform sinus, 480–481
unrecognized, in emergent settings, 491–494
in nonemergent settings, 489–491
Head lift, for testing recovery from neuromuscular blocking agents, 386–387
Heart, as source of emboli, arterial emboli, 104–106, 108
tumor emboli, 82–83
Heart failure, distinguishing from amniotic fluid embolism, 61
left ventricular failure, in amniotic fluid embolism, 62–63, 72
Hemangioma, subglottic, surgery of, airway management in, 496–498
Hematoma, following otolaryngologic surgery, 646, 687
Hemiplegia, and neuromuscular blocking agents, 410–411
Hemorrhage, in amniotic fluid embolism, 59–60
diclofenac and, 821

Hemorrhage *(Continued)*
following otolaryngologic surgery, 645–646
hematoma and, 646
postanesthesia recovery care and, 687–688
in tonsillectomy and adenoidectomy, 645–646
tracheal stoma bleeding and, 646
following tracheostomy, 646
ketorolac and, 819, 820
in take-back patients, direct laryngeal visualization in, 663
indirect laryngeal visualization in, 666
retrograde intubation techniques in, 668
in therapeutic embolization procedures, 182, 183
Heparin, for amniotic fluid embolism, 70
for arterial embolism, 127, 129, 133
in conjunction with therapeutic embolization procedures, 172
Hepatic encephalopathy, flumazenil for, 810
Hepatitis, transmitted in blood, 628
Histamine antagonists, and neuromuscular blocking agents, 437–438
Histamine release of benzylisoquinolinium compounds, 254, 255, 257, 326, 762
HIV infection, transmitted in blood, 628
Hydralazine, for induction of hypotension, 606
Hydraulic model of drug delivery techniques. See *Pharmacokinetics and pharmacodynamics of continuous infusion.*
Hydroxyzine, in therapeutic embolization procedures, 176
Hyperbaric oxygen therapy, for arterial and venous gas embolisms, 147–151
multiplace and monoplace chambers, 149–150
outcome following treatment of arterial gas embolism, 150
Hyperkalemia, as complication of succinylcholine, 315–316, 410, 411, 412–413, 414–415
in massive blood transfusion, 627
Hypertension, in otolaryngologic surgery, 641
Hyperthermia, malignant, as complication of sevoflurane, 725
as complication of succinylcholine, 318, 420
Hypotension, caused by muscle relaxants, 255, 257, 258, 325
controlled, in therapeutic embolization procedures, 182
curare as cause of, 325
induced, **593–609**
efficacy of, 594–595
monitoring of, 602–604
pharmacologic agents for, 604–607, 608
adenosine, 605
captopril, 606
clonidine, 606, 607
desflurane for, 721
enflurane, 604
esmolol, 605, 607
fenoldopam, 605
halothane, 604, 606
hydralazine, 606
indoramin, 608
isoflurane, 604, 606, 608
labetalol, 606, 607
nicardipine, 605, 608
nitroglycerin, 605, 606–607, 608
sodium nitroprusside, 605, 606, 607, 608
trimethaphan, 605, 607
physiologic basis for, 595–597
risks of, 597–602
cardiovascular complications and, 601
cerebral blood flow and, 598–601
vascular complications and, 601–602
techniques for inducing, 604–608
pharmacologic agents for, 604–607, 608
techniques to avoid, 607–608
usefulness of, 602
in otolaryngologic surgery, 641
Hypothermia, in blood transfusion, 625–626
Hypoxemia, and fat embolism, 29, 33, 36, 45
and hypoventilation, in otolaryngologic surgery, 637–640
airway disconnection in, 638–639
intermittent apneic technique and, 639
postoperative respiratory compromise in, 639–640
in tumor embolism, 81

Ibuprofen, benefits of, 822
perioperative use of, 817
Immobilization atrophy, and neuromuscular blocking agents, 421
Indirect mirror examination, in preoperative airway evaluation, 466
Indomethacin, 822
Indoramin, for induction of hypotension, 608
Infants and children, airway effects of desflurane in, 721

complications of neuromuscular blocking agents in, 433–434
ketorolac effects in, 819
nitrous oxide combined with desflurane in, 710
propofol usage in, 832, 833
reversal of neuromuscular blocking agents in, 400–401
steroidal muscle relaxants in, 296–297, 759–763
atracurium, 762
doxacurium, 763
mivacurium, 760–761
pipecuronium, 762–763
rocuronium, 761
vecuronium, 761–762
Infections, and neuromuscular blocking agents, 420
Infectious emboli, **86–93**
anesthetic considerations, 91–93
clinical manifestations of, 87–89
anaerobic organisms, 88–89
gram-negative organisms, 88
gram-positive organisms, 87–88
diagnosis of, 89
septic shock in, 92–93
treatment of, 89–91
Infusion of anesthesia. See *Pharmacokinetics and pharmacodynamics of continuous infusion.*
Injectable nonsteroidal anti-inflammatory drugs. See *Nonsteroidal anti-inflammatory drugs.*
Inotropic agents, for amniotic fluid embolism, 69
and infectious embolism, 91
in tumor embolism, 85
Intensive care, neuromuscular blocking agents in, **345–359**
monitoring of muscle relaxants, 356
pharmacokinetics and breakdown products, 346, 347–350
ventilatory treatment, 350–356
administration of relaxants, 353
complications, 354–355
prolonged use, 353–354
propofol for sedation in, 839
Interaction of neuromuscular blocking agents, with agents other than anesthetics, 435–440
with anesthetics, 432–435
combined use of nondepolarizing neuromuscular blocking agents, 431–432
intraoperative use of combined agents, 329
International Cooperative Aneurysm Study, 173, 174
Interventional neuroradiologic procedures. See *Therapeutic embolization of neurovascular lesions.*
Intracranial lesions, and neuromuscular blocking agents, 410–411, 412
Intracranial pressure, after flumazenil administration, 805–806
as complication of succinylcholine, 316
Intraocular pressure, as complication of succinylcholine, 316–317
flumazenil effect on, 806
Intraoperative use of muscle relaxants, **325–344**
dosing regimens, 328–330
drug selection, 325–328
duration of action and recovery times, 326
infusions, 333–334
maintenance and recovery, 332–336
monitoring of function, 330–332, 334–336
onset of block, 325–332
supplemental dosing, 332–333
Isoflurane, in ambulatory otorhinolaryngologic surgery, 530
desflurane vs., 714–715, 721
for induction of hypotension, 604, 606, 608
nausea and vomiting related to, 838
physical characteristics of, 707
in therapeutic embolization procedures, 178, 179, 180, 182
in tumor embolism, 85

Jet stylet catheter, 501
Junctional receptors, 208, 210–213

Kanamycin, and interaction with muscle relaxants, 92
Ketamine, in amniotic fluid embolism, 69
combined with propofol, 840
in infectious embolism, 93
and neuromuscular blocking agents, 435
Ketoprofen, 822
Ketorolac, 817–820
effectiveness of, 818, 820
gastric mucosal injury from, 819
morphine-sparing effect of, 819
morphine vs., 820
pediatric use of, 819
side effects of, 819
summary of pharmacokinetic and dosing in coexisting conditions, 818
Kidney failure, and use of muscle relaxants, 768–771
atracurium, 741, 769
doxacurium, 771
mivacurium, 769
pipecuronium, 770–771

Kidney failure *(Continued)*
rocuronium, 742–743, 769–770
steroidal muscle relaxants, 294–295
vecuronium, 769–770

Labetalol, for induction of hypotension, 606, 607
Laryngeal mask airway, 670–671
Laryngeal neoplasms, preoperative airway evaluation and, 457–458
Laryngectomy, total, airway management in, 696
Laryngoscopy, direct, in difficult tracheal intubation, 657–663
airway bleeding and, 663
blind tracheal intubation and, 661–662
space-occupying airway lesions and, 657–661
grading classification of, 459, 476
in preoperative airway evaluation, 466
indirect, in difficult tracheal intubation, 663–666
airway bleeding and, 666
airway edema and, 666
respiratory compromise following, 639–460
safety considerations in, 696–698
soft tissue injury following, 643
Laryngospasm, following otolaryngologic surgery, 685
Laser surgery, **573–590**
airway fires in, case study of, 494–496
management of, 588
prevention of, 581–584, 697
anesthesia in, 579–590
endotracheal tubes for, Bivona Fome-Cuf laser endotracheal tube, 586–587
Mallinckrodt Laser-Flex endotracheal tube, 588
Norton laser endotracheal tube, 584–585
prevention of combustion in, 581–584
wrapping in metal foil, 582–583
Xomed Laser-Shield endotracheal tube, 587–588
induction of, 580
premedication for, 580
preoperative evaluation and, 579–580
special considerations in, 580–584
Venturi jet ventilation of lungs, 589–590
argon laser, 577
carbon dioxide laser, 575–577
neodymium-yttrium-aluminum-garnet laser, 578
operating room hazards in, 578–579
principles of laser technology, 573–575
ruby laser, 578
Laudanosine, as breakdown product of atracurium, 348–350, 353, 739
Le Fort I-III fractures, 512–513
Left ventricular failure, in amniotic fluid embolism, 62–63, 72
Lidocaine, in ambulatory otorhinolaryngologic surgery, 533
for arterial or venous gas embolism, 152
in therapeutic embolization procedures, 178
Ligand-gated receptors, 206
Limbs. See *Extremities.*
Liver disorders, and muscle relaxants, atracurium, 768
doxacurium, 768
mivacurium, 766–767
rocuronium, 767
steroidal muscle relaxants, 295–296, 348
vecuronium, 767–768

Mallampati airway classification scheme, 458–459, 477
Mandibular space measurement, in evaluation of difficult intubation, 460, 478
Mandibular trauma. See *Maxillofacial/mandibular trauma.*
Mannitol, for arterial embolism, 132
in therapeutic embolization procedures, 180
and tumor embolism, 86
Mask ventilation, difficulties in, 476
Masseter spasm, as complication of succinylcholine, 318
Massive blood transfusions. See *Blood transfusion, massive.*
Mastoidectomy, 551
Maxillofacial/mandibular trauma, **509–522**
anatomy of injuries in, 511
anesthetic approach in, 520–522
anesthetic management of, 514–520
awake tracheal intubation in, 518–519
Bullard laryngoscope-aided tracheal intubation in, 520
cricothyrotomy criteria and, 521
criteria for administration of, 510–511
fiberoptic-aided tracheal intubation in, 519–520
Le Fort I fracture in, 512
Le Fort II fracture in, 512–513
Le Fort III fracture in, 513

of lower third of the face, 511
of middle third of the face, 511–514
nasorbitoethmoid (NOE) fractures in, 513
nasotracheal intubation in, 516–518
postanesthetic management of, 522
transtracheal techniques in, 520, 521
of upper third of the face, 513
Maximum inspiratory pressure (MIP), for testing recovery from neuromuscular blocking agents, 384–385, 387
Mechanomyogram (MMG), for monitoring of muscle relaxant response, 362, 373–374, 393
Mediastinal masses, evaluation of, in preoperative airway evaluation, 468–469, 470
Ménière's disease, 552
Mesenteric emboli, 123–125
Methohexital, propofol vs., 839
in therapeutic embolization procedures, 176, 177, 178
Methotrexate, and tumor embolism, 86
15-Methyl-$PGF_2\alpha$ (Hemabate), in amniotic fluid embolism, 70
Methylergonovine, in amniotic fluid embolism, 70
Metoclopramide, for prevention of nausea and vomiting, 537–538, 688
Metocurine, basic pharmacology of, 267, 268
chemical structure of, 221, 267
Microemboli, in stored blood, 630
Midazolam, complications from, 529
for prevention of patient awareness, 641
propofol vs., 836, 837
reciprocal dose-dependent effects of benzodiazepines and flumazenil, 801–802
in therapeutic embolization procedures, 176, 177, 178
in tumor embolism, 85
Mill-wheel murmur, 2, 8, 16
Minute ventilation, for testing recovery from neuromuscular blocking agents, 383, 387
Misoprostol, protection against gastric injury from NSAIDs, 823
Missile emboli, 94–95, 96–97
Mitral valve prolapse, and atrial embolization, 107
Mivacurium, 273–277. See also *Benzylisoquinolinium neuromuscular blocking drugs.*
in ambulatory otorhinolaryngologic surgery, 531–532
antagonism of, 261, 757–759
autonomic blocking properties of, 255, 256–257
basic pharmacology of, 273–274
cardiovascular effects of, 276–277
chemical structure of, 274, 735
clinical neuromuscular pharmacology of, 274–275
comparative metabolism of, 739–740
comparative pharmacokinetics of, 731, 742, 743–744
duration of, 233, 326, 329
in ear surgery, 555
in elderly patients, 765–766
histamine release effects of, 257, 258, 259, 326, 329
infusion rate of, 333–334
interaction with other drugs, 432–433
in kidney failure, 769
kinetics and metabolism of, 275–276
in liver disease, 766–767
metabolism of, 263, 373, 736
onset time of, 752
peak blocking effect of, 745, 746
in pediatric patients, 760–761
recovery time, 335, 737
stereoisomers of, 737, 743–744
structure-activity relationships, 735–737
MMG. See *Mechanomyogram (MMG).*
Monitored anesthesia care, in therapeutic embolization procedures, 176–178
Morphine, ketorolac vs., 820
morphine-sparing effect of ketorolac, 819
Multiple sclerosis, and neuromuscular blocking agents, 412
Muscarinic receptors, and neuromuscular blocking agents, 222, 244–245, 327
Muscle fasciculations, as complication of succinylcholine, 315
Muscle receptors, 206–213
biosynthesis of, 209
chemistry of, 207–209
morphology of, 206–207
types of, 210–213
Muscle relaxants, acetylcholine receptors and, **205–218**
ligand-gated receptors, 206
muscle receptors, 206–213
neural receptors, 213–215
in ambulatory otorhinolaryngologic surgery, 531–532
antagonism of residual blockade, 753–759
in agents of intermediate-duration, 755–757
clinical recommendations for, 759, 760
future alternatives, 759
in long-acting agents, 754–755
mivacurium, 757–759
in short-acting agents, 757–759
benzylisoquinolinium neuromuscular blocking drugs, **251–281**
general pharmacology of, 253–264

Muscle relaxants *(Continued)*
history and background of, 251–253
specific drugs, 265–277
clinical tests of recovery, **379–389**
airway protection, 385–386
muscles of airway protection, 381–382
muscles of ventilation, 379–381
tests, 382–385, 386–388
comparative metabolism of, 737–740
benzylisoquinolinium muscle relaxants, 738–740
atracurium, 738–739
doxacurium, 739
mivacurium, 739–740
steroidal muscle relaxants, 737–738
pipecuronium, 738
vecuronium and rocuronium, 737–738
comparative pharmacokinetics of, 731, 740–744
atracurium, 741
doxacurium, 740–741
mivacurium, 743–744
pipecuronium, 740
rocuronium, 742–743
vecuronium, 741–742
complications involving concurrent diseases, **409–425**
burns, 420–421
immobilization atrophy, 421
infections, 420
intracranial lesions, 410–412
muscular lesions, 418–420
neuromuscular junction lesions, 416–417
peripheral nerve lesions, 414–416
regional curare test, 409–410
spinal cord lesions, 413–414
complications involving drug interactions, **427–444**
agents other than anesthetics, 435–440
anesthetics, 432–435
nondepolarizing neuromuscular blocking agents, 430–432
succinylcholine, 427–430
in ear surgery, 555–556
in elderly patients, 763–766
doxacurium and pipecuronium, 763–764
mivacurium, 765–766
rocuronium compared with atracurium and vecuronium, 764–765
intensive care use of, **345–359**
indications and use in ventilatory treatment, 350–356
pharmacokinetics, 347–350
intraoperative use of, **325–344**
maintenance and recovery, 332–336
onset of block, 325–332
kinetics and dynamics in central (airway) and peripheral muscles, 744–747
in liver disease, 766–768
atracurium, 768
doxacurium, 768
mivacurium, 766–767
rocuronium, 767
vecuronium, 767–768
neuromuscular blocking agents, **219–235**
classification of, 219–220, 233
clinical choice of relaxant, 233–234
depolarizing block, 229–232
general concepts, 220–229
nondepolarizing block, 232–233
new relaxants, **729–778**
actions in various patient groups, 759–771
antagonism of residual blockade, 753–759
comparative metabolism of, 737–740
comparative pharmacokinetics of, 740–744
kinetics and dynamics in central (airway) and peripheral muscles, 744–747
onset of blockade, 747–753
structure-activity relationships of, 729–737
onset of blockade, 747–753
drug potency and, 747–750
of mivacurium, 751–753
plasma clearance and, 750–753
of rocuronium, 749–750
in otolaryngologic surgery, 643, 696
in pediatric patients, 759–763
atracurium, 762
doxacurium, 763
mivacurium, 760–761
pipecuronium, 762–763
rocuronium, 761
vecuronium, 761–762
in renal failure, 768–771
doxacurium, 771
mivacurium and atracurium, 769
pipecuronium, 770–771
rocuronium and vecuronium, 769–770
reversal of neuromuscular blocking agents, **237–249**, **391–407**
adverse effects of reversal agents, 401–402
age of patients and, 400–401
aminopyridines for, 245–246
anesthetic agents and, 400
anticholinesterase agents for, 237–245
evoked recovery, 394–400
measurement of recovery, 392–394, 402–403
steroidal muscle relaxants, **283–307**
in cardiac surgery, 299

in kidney and liver dysfunction, 294–296
in obesity, 299–300
pharmacodynamics of, 285–287
pharmacokinetic-pharmacodynamic modeling of, 292–294
pharmacokinetics of, 287–292
in pregnancy, 298–299
in specific age groups, 296–298
structure-activity relationships of, 283–285, 730–733
structure-activity relationships of, 729–737
benzylisoquinolinium substances, 733, 735–737
doxacurium, 733, 735
mivacurium, 735–737
steroidal substances, 283–285, 730–733
pipecuronium, 730
rocuronium, 731, 733, 734
succinylcholine, **309–324**
advantages of, 313–315
complications of, 315–319
pharmacokinetics and pharmacodynamics, 309–313
twitch monitoring of neuromuscular blockade, **361–378**
clinical assessment of, 369–371
intraoperative monitoring of, 361–362
kinetics and dynamics in central (airway) and peripheral muscles, 744–747
nerve stimulation, 362–366
onset of block, 367–369
recording devices, 373–374
restoring neuromuscular function, 371–373
Muscular denervation, and neuromuscular blocking agents, 415–416
Muscular dystrophies, and neuromuscular blocking agents, 419–420
Myalgia, as complication of succinylcholine, 315
Myasthenia gravis, and neuromuscular blocking agents, 416–417
Myasthenic syndrome, and neuromuscular blocking agents, 417
Myocardial infarction, in otolaryngologic surgery, 640
Myotonias, and neuromuscular blocking agents, 418–419
Myringotomy, 550

Naproxen, 817
Narcotics. See *Opioids.*
Nasal surgery, airway management in, 694–695
Nasopharyngoscopy, in preoperative airway evaluation, 466
Nasotracheal intubation, in maxillofacial/mandibular trauma, 516–518
Nausea and vomiting, after ear surgery, 556
after flumazenil, 809
after otolaryngologic surgery, 688
after propofol, 836, 838
in ambulatory otorhinolaryngologic surgery, 534–538
anesthetic agents and, 535–536
anesthetic techniques and, 535
pain and, 536
preoperative history and, 536
prophylaxis and treatment of, 536–538
type of surgical procedure and, 536
opioids causing, 555
Neck extension, in evaluation of difficult intubation, 460
Neodymium-yttrium-aluminum-garnet laser, 578, 581
Neostigmine, 240–242
antagonism of neuromuscular blocking agents, agents of intermediate duration, 755
benzylisoquinolinium compounds, 261, 264
effectiveness of, 395–401, 429
long-acting agents, 755
mivacurium, 758
recommended dosage, 760
succinylcholine, 313
chemical structure of, 240
edrophonium vs., 244
mode of action, 238–240
pharmacokinetics •, 241–242
side effects and drug interactions, 244–245, 402
Nerve damage, postoperative, assessment of, 689
peripheral neuropathies, 642–643
prevention of, in head and neck surgery, 696
Neural receptors, 213–215
Neuromuscular block, defined, 224
prolonged, as complication of succinylcholine, 319
Neuromuscular blocking agents, **219–235**. See also *Muscle relaxants; specific agents.*
characteristics of neuromuscular block, 220
chemical structure of, 221
classification of, 219–220, 233
clinical choice of relaxant, 233–234
depolarizing block, 229–232
dose-response relationship, 227–229
neuromuscular block vs. receptor block, 224–225

Neuromuscular blocking agents *(Continued)*
neuromuscular margin of safety, 222–224
nondepolarizing block, 232–233
pharmacokinetic considerations, 225–227
phase II block, 231–232
structure-activity relationships, 220–222
succinylcholine metabolism, 230–231
Neuromuscular function, effect of desflurane on, 719
Neurovascular lesions, embolization of. See *Therapeutic embolization of neurovascular lesions.*
Nicardipine, for induction of hypotension, 605, 608
and neuromuscular blocking agents, 439
Nicotinic cholinergic receptors, 214–215, 232
Nicotinic receptors. See also *Acetylcholine receptors.*
binding sites, 252
effect of anticholinesterase agents, 239
as ligand-gated receptors, 206
number and types of, 210
Nifedipine, and neuromuscular blocking agents, 439
in tumor embolism, 85
Nimodipine, and neuromuscular blocking agents, 439
for ruptured intracranial aneurysm, 170
Nitroglycerin, for amniotic fluid embolism, 70
for induction of hypotension, 605, 606–607, 608
Nitrous oxide, air embolism and, 17, 179
in ambulatory otorhinolaryngologic surgery, 531
and combustion of endotracheal tubes in laser surgery, 584
desflurane combined with, 710, 713, 714–715
desflurane vs., 709
differential solubility of, 560
diffusion rate of, 560
in ear surgery, **559–570**
decreased middle ear pressure and, 569
effects on hearing, 568
increased middle ear pressure and, 562–566
summary of complications, 570
tympanoplasty and, 566–567
increased middle ear pressure and, 562–566
adenotonsillectomy and, 565
nausea and vomiting related to, 564
rate of pressure change in, 565–566, 567
regulatory forces in, 561–562
reversal of retracted tympanic membrane, 564
serous otitis media and, 564–565
tympanic membrane rupture in, 562–563
in infectious embolism, 93
nausea and vomiting caused by, 535, 564
sevoflurane with, 724
in tumor embolism, 85
uptake in body air spaces, 559–562
Nondepolarizing neuromuscular blocking agents, 232–233
benzylisoquinolinium compounds, 260
chemical structure, 221
combined use, 431–432
defined, 220
effect of succinylcholine, 427–429
following succinylcholine (precurarization), 429–430
pharmacology of, 232–233
priming principle, 430–432
Nonsteroidal anti-inflammatory drugs, **815–829**
adverse effects of, 817
aspirin, 822
gastric protection from NSAID injury, 823
ibuprofen, 822
indomethacin, 822
inhibition of prostaglandin synthesis, 815–816
injectable, 817–822
diclofenac, 821
ketorolac, 817–820
ketoprofen, 822
nonanalgesic benefits of, 817
perioperative use of, 817
piroxicam, 822
structure and function of, 815–817
Norepinephrine, for amniotic fluid embolism, 69, 70
in infectious embolism, 91
NSAIDs. See *Nonsteroidal anti-inflammatory drugs.*

Obesity, risk of postanesthetic nausea and vomiting and, 535–536
and use of steroidal muscle relaxants, 299–300
Ondansetron, for prevention of nausea and vomiting, 538
Opioids, in ear surgery, 555
intravenous, in ambulatory otorhinolaryngologic surgery, 532–534
and neuromuscular blocking agents, 435
in therapeutic embolization procedures, 177, 179

in tumor embolism, 85
Orbicularis oculi muscle, and monitoring of muscle relaxants, 332, 335, 363, 367–368, 370, 375
Org 7617, 284
Org 9273, 284
Org 9616, 284, 286. See also *Steroidal muscle relaxants.*
Oxytocin, in amniotic fluid embolism, 70

Packed red blood cells, 620–621
Pancuronium. See also *Steroidal muscle relaxants.*
breakdown products, 347
chemical structure, 221, 284, 285
comparative pharmacokinetics of, 731
complications of, 347, 411
for decreasing myalgias, 430
effect of succinylcholine, 428
infusion rate, 333
intensive care use, 346, 353
interaction with other drugs, 432–433
onset time, 731, 734, 747, 748
potency of, 286
reversal by antagonists, 395, 398, 400, 401, 755
in therapeutic embolization procedures, 178
twitch monitoring of, 370
Panendoscopy, respiratory compromise following, 639–460
Papaverine, in transluminal angioplasty, 171
Papillomatosis, respiratory, airway management in, 697
Paradoxical emboli, 107
Paraplegia, and neuromuscular blocking agents, 413
Parkinson's disease, and neuromuscular blocking agents, 412
Patient awareness, in otolaryngologic surgery, 641
with propofol, 641, 838, 839–840
Pediatric anesthesia. See *Infants and children.*
PEEP. See *Positive end expiratory pressure (PEEP).*
Penicillin, for treatment of infectious emboli, 89, 90
Pentobarbital, in therapeutic embolization procedures, 176
Percutaneous oxygenation, in take-back patients, 673–675
Peripheral emboli. See under *Arterial embolism.*
Peripheral neuropathies, following otolaryngologic surgery, 642–643
and neuromuscular blocking agents, 414–415
Petaline, 252
Petechiae, indicating fat embolism, 34
Pharmacokinetics and pharmacodynamics of continuous infusion, **779–797**
automated drug delivery, 789–793
closed-loop system, 789–791, 792
controllers, 791–793
proportional-integral-derivative (PID) controller, 789–791, 792
computer-assisted continuous infusion, 793–795
hydraulic model, 780–781
bolus dosing, 781–782
bolus plus infusion, 783–784
discontinuation of infusion, 785
dosing for effect, 787
effect compartment (biophase), 786
infusion, 782–783
infusion pumps, 788–789
computer-assisted, 788
nonvolumetric, 788
syringe pumps, 788–789
pharmacokinetic model, 780, 781
bolus dosing, 782
bolus plus infusion, 784
discontinuation of infusion, 785–786
dosing for effect, 788
effect compartment (biophase), 786–787
infusion, 783
regulation of intravenous drug delivery, 788
Pharyngeal neoplasms, preoperative airway evaluation and, 457–458
Phase II block, 331–332
Phenytoin, and therapeutic embolization procedures, 178
Phospholipase A (PLA), and amniotic fluid embolism, 68
Pipecuronium. See also *Steroidal muscle relaxants.*
cardiovascular effects of, 732
chemical structure of, 284, 285, 730
comparative metabolism of, 738
comparative pharmacokinetics of, 731, 740
in elderly patients, 763–764
interaction with other drugs, 433
in kidney failure, 770–771
in pediatric patients, 762–763
potency of, 286, 730
recovery time, 335
reversal by antagonists, 400, 755
structure-activity relationships, 730–733
succinylcholine and, 428
use with artificial ventilation, 353

Piriform fossa tumor, surgery of, airway management in, 485–486
Piriform sinus tumor, surgery of, airway management in, 480–481
Piroxicam, 822
Plaques, as emboli. See *Aortoarterial emboli.*
Plasma, in massive blood transfusion, 621–623
  calculation for replacement therapy, 622–623
  collection of, 621–622
  guidelines for use of, 622
Plasma cholinesterase, 229, 230
Plasma clearance, and onset time of muscle relaxants, 750–753
Platelets, in massive blood transfusion, 623–624
Pneumothorax, in otolaryngologic surgery, 644–645
Poliomyelitis, and neuromuscular blocking agents, 414
Polymyositis, and neuromuscular blocking agents, 420
Polymyxin B, and interaction with muscle relaxants, 92
Positive end expiratory pressure (PEEP), for treatment of air embolism, 7, 17
  for treatment of amniotic fluid embolism, 69
  for treatment of fat embolism, 47
Post-tetanic count (PTC), and monitoring of muscle relaxants, 334–335, 366, 369
Postanesthesia recovery. See *Recovery from ENT surgery.*
Pregnancy, and use of muscle relaxants, 298–299, 330
Preoperative airway evaluation. See *Airway, difficult, preoperative evaluation of.*
Priming dose, of neuromuscular blocking agents, 329–330
  of nondepolarizing neuromuscular blocking agents, 430–432
  of reversal agents, 397–398
Propofol, **831–844**
  in ambulatory otorhinolaryngologic surgery, 529–530
  in amniotic fluid embolism, 69
  cardiovascular effects of, 834–835
  central nervous system effects, 835–836
  in ear surgery, 554
  in elderly patients, 832
  induction of anesthesia by, 833–834
  and neuromuscular blocking agents, 434–435
  in outpatient anesthesia, 836–837
  pain on injection of, 834
  patient awareness and, 641, 838, 839–840
  patient satisfaction with, 838
  in pediatric patients, 832
  pharmacokinetics of, 831–833
    following bolus and infusion, 832
  recovery from, 838
  respiratory effects of, 834
  for sedation, in intensive care unit, 839
    during local and regional procedures, 837–838
  in therapeutic embolization procedures, 177, 178, 179
  for total intravenous anesthesia, 839–840
  in tumor embolism, 85
Prostaglandins, and amniotic fluid embolism, 67–68
  for arterial embolism, 132
  effects of, 816
  inhibition of synthesis by nonsteroidal anti-inflammatory drugs, 815–816
  synthesis pathway of, 816
Protamine, in therapeutic embolization procedures, 172
Pseudocholinesterases, antagonism of benzylisoquinolinium compounds, 262, 264
  breakdown of succinylcholine, 229, 230
  mivacurium as substrate of, 743
  screening patients for abnormal activity, 230–331
PTC. See *Post-tetanic count (PTC).*
Pulmonary angiography. See *Angiography.*
Pulmonary artery catheterization, in amniotic fluid embolism, 56
Pulmonary artery pressure, and development of air embolism, 4–5
  for diagnosis of air embolism, 12
  for diagnosis of fat embolism, 44
Pulmonary aspiration, distinguishing from amniotic fluid embolism, 61
Pulmonary edema, in amniotic fluid embolism, 56, 73
  indicating fat embolism, 35
  in therapeutic embolization procedures, 185
Pulmonary embolism, distinguishing from amniotic fluid embolism, 60
  in therapeutic embolization procedures, 184
  tumor emboli as etiology of, 79–82
Pulmonary function testing, in preoperative airway evaluation, 468–469
Pyridostigmine, chemical structure of, 240
  mode of action, 238–240
  pharmacokinetics, 242–243

Radiography, in preoperative airway evaluation, 466–468, 478

Ranitidine, and neuromuscular blocking agents, 437–438
protection against gastric injury from NSAIDs, 823
Receptor block, defined, 224
Recovery from ENT surgery, **681–690**
adequate oxygen perfusion, signs of, 683
airway compromise in, 684–687
artificial airways and, 686–687
edema in, 686
laryngospasm in, 685
anesthesia report in, 682–684
bleeding and, 687–688
immediate postanesthesia care unit admission, 681–682
inadequate oxygenation, signs and symptoms of, 682
inadequate ventilation, signs and symptoms of, 683
initial PACU assessment of, 684
nausea, vomiting, and vertigo in, 688
nerve damage and, 689
Recovery from neuromuscular blocking agents. See *Clinical tests of recovery from neuromuscular blocking agents; Reversal of neuromuscular blocking agents; Twitch monitoring of neuromuscular blockade.*
Red blood cells, packed, 620–621
Renal artery embolism, 119–120
Renal failure. See *Kidney failure.*
Respiratory effects of anesthetic agents, desflurane, 712
flumazenil, 804–805
propofol, 834
sevoflurane, 724
Respiratory failure, and infectious embolism, 91
Respiratory insufficiency, indicating fat embolism, 34
Retinopathy, indicating fat embolism, 35
Reversal of neuromuscular blocking agents, **237–249**, **391–407**
adverse effects of reversal agents, 401–402
age of patients and, 400–401
aminopyridines, 245–246
antagonism of benzylisoquinolinium compounds, 260–262
anticholinesterase agents, 237–245, 396
chinothylinum, 245
edrophonium, 243–244, 395, 396, 397, 398–399, 402
evoked recovery, 394–400
factors influencing success of, 394–395
from moderate block, 396–398
from profound block, 395–396
from shallow block, 398–400
galanthamine, 245
inhalational anesthetic agents and, 400
measurement of recovery, 392–394, 402–403
neostigmine, 240–242, 395–400, 402
priming, 397–398
pyridostigmine, 242–243
reversal agents, **237–249**
mode of action, 238–240
side effects and drug interactions, 244–245
when to avoid, 403
Rocuronium. See also *Steroidal muscle relaxants.*
antagonism of, 757
chemical structure of, 284, 734
comparative metabolism of, 737–738
comparative pharmacokinetics of, 731, 742–743
in elderly patients, 764–765
interaction with other drugs, 329, 435
in kidney failure, 769–770
in liver disease, 767
onset time, 328, 329, 731, 733, 734, 749–750
peak blocking effect of, 745–746
in pediatric patients, 761
potency of, 286, 731, 749–750
priming principle and, 431
recovery time, 335
structure-activity relationships, 731
Ruby laser, 578

Saddle aortic emboli, 117–118
Safety considerations in otolaryngologic surgery, **637–647**, **693–698**
communication between surgeon and anesthesiologist, 693–694
endoscopic procedures, 696–698
head and neck surgery, 695–696
hemorrhage, 645–646
hypertension or hypotension, 640–641
hypoxemia and hypoventilation, 637–640
airway disconnection in, 638–639
intermittent apneic technique and, 639
postoperative respiratory compromise in, 639–640
myocardial infarction, 640
nasal and sinus surgery, 694–695
patient awareness, 641
pneumothorax, 644–645
position and movement injuries, 641–643
peripheral neuropathies in, 642–643
stroke in, 642
soft tissue injury, 578–579, 643–645
tracheostomy, 646–647
vascular access complications, 644–645
Seizures, caused by flumazenil, 811
Septic emboli. See *Infectious emboli.*

Serous otitis media, nitrous oxide anesthesia and, 565
Sevoflurane, 722–726
adverse effects of, 725
cardiovascular effects of, 724, 725
in ear surgery, 555
emergence from, 724
malignant hyperthermia from, 725
metabolism of, 724
nitrous oxide with, 724
pharmacokinetics of, 722–723
physical characteristics of, 707
respiratory effects of, 724
stability of, 723
toxicity of, 724
unavailability in United States, 707
Sinus surgery, airway management in, 694–695
Sniffing position, in evaluation of difficult intubation, 478
Sodium bicarbonate, for arterial embolism, 132
Sodium nitroprusside, for induction of hypotension, 605, 606, 607, 608
for ruptured intracranial aneurysm, 170
in therapeutic embolization procedures, 182
Somatosensory evoked potentials (SEPs), for monitoring of therapeutic embolization, 169, 180–181
Spinal arteriovenous malformations and tumors, therapeutic embolization of, 168–169
Spinal cord lesions, and neuromuscular blocking agents, 413–414
Squamous cells, and diagnosis of amniotic fluid embolism, 61–62
Stapedectomy, 551
Steroidal muscle relaxants, **283–307**
analytical methods, 287–288
in cardiac surgery, 299
chemical structure of, 284
comparative metabolism of, 737–738
pipecuronium, 738
vecuronium and rocuronium, 737–738
distribution of, 288–290
in elderly patients, 297–298
elimination of, 292
in hepatic dysfunction, 295–296
in infants and children, 296–297
infusion kinetics, 293–294
kinetics and paralysis, 291–292, 292–294
metabolism of, 290–291
in obesity, 299–300
pharmacodynamics, in healthy patients, 285–287
pharmacokinetic-pharmacodynamic modeling, 292–294
pharmacokinetics, in healthy patients, 287–292
in pregnancy, 298–299
relative potency of, 286
in renal failure, 294–295
structure-activity relationships, 283–285, 730–737
pipecuronium, 730–733
rocuronium, 731
Streptokinase, for arterial embolism, 132, 134
in conjunction with therapeutic embolization procedures, 172
Streptomycins, and interaction with muscle relaxants, 92
Stroke. See *Cerebrovascular accident.*
Submandibular mass, surgery of, airway management in, 483–485
Succinylcholine, **309–324**
in ambulatory otorhinolaryngologic surgery, 531
in amniotic fluid embolism, 69
antagonizing with anticholinesterases, 313
chemical structure, 221
compared with acetylcholine, 229
complications of, 315–319, 326–327, 427–430
anaphylaxis, 318
cardiovascular effects, 317, 326–327
fasciculations, 315
hyperkalemia, 315–316, 410, 411, 412–413, 414–415
intracranial pressure, 316
intragastric pressure, 317
intraocular pressure, 316–317
malignant hyperthermia, 318, 420
masseter spasm, 318
myalgia, 315
continuous infusion of, 311–312
duration of, 233, 312
interaction with other neuromuscular blocking agents, 427–428
intubation and, 313–314, 328
maintenance of blockade, 311, 314–315
metabolism of, 230–231
onset of, 310–311
peak blocking effect of, 745, 746
pharmacokinetics and pharmacodynamics of, 309–313
potency of, 310
precurarization and, 429–430
prolonged neuromuscular blockade, 319
recovery time, 313
single-bolus dosage, 311
and tumor embolism, 86
Sucralfate, 823
Sufentanil, desflurane vs., 713–714

Surgeon's view of anesthesia in otolaryngologic surgery. See *Safety considerations in otolaryngologic surgery.*

Take-back patients. See *Airway, difficult, in take-back patients.*
Terbutaline, for reactions to contrast media, 186
Tetanus (infection), and neuromuscular blocking agents, 420
Tetanus of muscle, monitoring of muscle relaxant response, 364, 372
  tetanic stimulation, 364, 366, 392, 403
  tetanization, 364
Tetracyclines, and interaction with muscle relaxants, 92
Therapeutic embolization of neurovascular lesions, **157–195**
  anesthesia for, 175–182
    controlled hypotension, 182
    evoked potential monitoring, 180–181
    general anesthesia, 178–180
    monitored anesthesia care, 176–178
    preanesthetic considerations and premedication, 175–176
  arteriovenous fistulas, 163–164
  brain arteriovenous malformations, 164–165, 166, 167
  catheter systems, 159
  clinical applications, 158, 161
  complications of, 182–187
  dural arteriovenous malformations, 162–163
  embolic agents, 161
  general procedure, 158–161
  intracranial aneurysms, 165–168
    rebleeding vs. surgical risks, 173–174
    risk of surgery and radiosurgery, 172–173
  intracranial tumors, 162
  risks of endovascular therapy, 174–175
  spinal arteriovenous malformations and tumors, 168–169
  thrombolytic therapy, 171–172
  transluminal angiography, 169–171
  tumors of external carotid circulations, 161–162
Thiopental, in amniotic fluid embolism, 69
  in ear surgery, 554
  propofol vs., 839
  in therapeutic embolization procedures, 178, 179
  in tumor embolism, 85
Thrombocytopenia, and fat embolism, 33
Thrombolytic therapy, in arterial embolism, 131–135
  during therapeutic embolization procedures, 171–172
Thrombosis, differentiation from embolism, 126–127
Thumb muscle. See *Adductor pollicis muscle.*
Tidal volume, for testing recovery from neuromuscular blocking agents, 383, 387
Tissue plasminogen activator (TPA), for arterial embolism, 134
  in conjunction with therapeutic embolization procedures, 172
Tongue neoplasms, surgery of, airway management in, 489–494
Tonsillectomy, in ambulatory surgical settings, 539–540
  hemorrhage following, 645–646
Tracheal intubation, difficult. See also *Airway, difficult.*
  in maxillofacial/mandibular trauma, Bullard laryngoscope-aided, 520
  fiberoptic-aided, 519–520
  nasotracheal, 516–518
  physical indicators of, 458–465
    airway obstruction evaluation, 462–464
    bivariate prediction of difficulty, 461
    craniofacial syndromes and, 465
    direct laryngoscopy grading classification, 459, 476
    facial and laryngeal trauma, 464–465
    Mallampati airway classification scheme, 458–459, 477
    mandibular space measurement, 461–462, 478
    neck extension, 460–461
    in pediatric patients, 463–464
    previous history of, 454–455
    sniffing position, 478
    temporomandibular joint dysfunction, 462
  in take-back patients, 656–669
    algorithm for patient selection, 654
    direct laryngeal visualization and, 657–663
    fluoroscopic control of, 667
    indirect laryngeal visualization and, 663–666
    light wand guidance for, 666–667
    passing of endotracheal tube into trachea, 669
    retrograde techniques, 667–669
Tracheal stoma, hemorrhage of, following otolaryngologic surgery, 646
  obstructed, airway management in, 486–487
Tracheostomy, complications of, 646–647
  in postanesthesia recovery care, 686–687
Tracheotomy, preoperative airway evaluation and, 456, 695

Train-of-four (TOF) stimulation, after edrophonium, 373, 374
defined, 364
in intensive care settings, 356
monitoring of muscle relaxants, 332, 335
monitoring of recovery from neuromuscular blocking agents, 392–393, 403, 753–754
in agents of intermediate duration, 755–757
in agents of long duration, 754–755
in agents of short duration, 757–759
recommended dosage of neostigmine or edrophonium in response to, 760
Trimethaphan, for induction of hypotension, 605, 607
d-Tubocurarine, autonomic blocking properties, 255, 256–257
basic pharmacology of, 265, 267
chemical structure of, 221, 251–252, 265
for decreasing myalgias, 430
histamine release effects, 257, 258
increased plasma concentration of prostaglandin and, 257, 260
onset time, 731, 734, 747, 748
potency of, 253–254
reversal by antagonists, 395
synergism with rocuronium, 329
Tumor embolism, **79–86**
anesthetic considerations, 84–86
arterial emboli, 82–83
cardiac sources of, 82–83
extracardiac sources of, 83
sites of distal tumor embolism, 83
pulmonary emboli, 79–82
symptoms and treatment of, 83–84
Tumors, therapeutic embolization of, external carotid circulation tumors, 161–162
intracranial tumors, 162
spinal arteriovenous malformations and tumors, 168–169
Twitch monitoring of neuromuscular blockade, **361–378**. See also *Clinical tests of recovery from neuromuscular blocking agents.*
abdominal muscle relaxation, 369
detecting reversible block, 370–371
double-burst stimulus (DBS), 372, 393–394
in intensive care settings, 356
intraoperative monitoring, 331–332, 361–362
kinetics and dynamics in central (airway) and peripheral muscles, 744–747
nerve stimulation, 362–363
onset of block, 367–369
pitfalls, 366–367
profound blockade, 369–370
recording devices, 373–374
restoring neuromuscular function, 371–373
single twitch, 364–66, 392
summary, 375
tetany, 364–66, 392
train-of-four, 364–66, 392–393
Tympanic membrane, reversal of retracted membrane, using nitrous oxide, 564
rupture of, due to nitrous oxide anesthesia, 562–563
Tympanoplasty, nitrous oxide and, 566–567
surgical considerations in, 551
Tympanotomy tube placement, 550–551

Ultrasonography, Doppler. See *Doppler ultrasonography.*
Upper respiratory infections, in ambulatory surgery, 540–542
Urokinase, for arterial embolism, 132, 134
in conjunction with therapeutic embolization procedures, 172

Vancomycin, and neuromuscular blocking agents, 436
Vascular access, complications of, in otolaryngologic surgery, 644–645
Vascular blood flow, in induced hypotension, 601–602
Vasopressors, in infectious embolism, 91
Vecuronium. See also *Steroidal muscle relaxants.*
in ambulatory otorhinolaryngologic surgery, 532
breakdown products, 347–348
cardiovascular effects of, 434
chemical structure of, 221, 284, 285
comparative metabolism of, 737–738
comparative pharmacokinetics of, 731, 741–742
duration of, 234, 326, 329, 403
effect of succinylcholine, 428
in elderly patients, 764–765
infusion rate, 333–334
intensive care use, 346–348, 353
interaction with other drugs, 432–434, 435, 437–438
in kidney failure, 769–770
in liver disease, 767–768
onset time, 328, 747
peak blocking effect of, 745
in pediatric patients, 761–762
potency of, 286
and precurarization, 430
priming principle and, 431

recovery time, 335
reversal by antagonists, 395–401, 755, 756
in therapeutic embolization procedures, 178
twitch monitoring of, 369, 370
Vein of Galen malformation, therapeutic embolization of, 163, 173, 179, 185
Venous air embolism (VAE). See *Air embolism.*
Ventilation and neuromuscular blocking agents. See *Clinical tests of recovery from neuromuscular blocking agents; Intensive care, neuromuscular blocking agents in.*
Ventricular emboli, 107–108
Venturi jet ventilation, in laser surgery, 589–590
in surgery of subglottic hemangioma, 497
transtracheal, in take-back patients, 674–675
Vertigo, after otolaryngologic surgery, 688
Videolaryngoscopy, in preoperative airway evaluation, 471
Vital capacity, for testing recovery from neuromuscular blocking agents, 383–384, 387
Vocal card papillomata, surgery of, airway management in, 494–496
Voice quality, in preoperative airway evaluation, 456
Volatile anesthetics, **707–728**
characteristics of ideal anesthetic agents, 708
desflurane, 708–722
animal studies of, 721
cardiovascular effects of, 712–718
central nervous system effects of, 718–719
dosage, 710
emergence from, 719–721
neuromuscular function of, 719
nitrous oxide vs., 709
nitrous oxide with, 710, 713, 714–715
pediatric uses, 721
pharmacokinetics of, 709–710
release of fluoride by, 711
respiratory effects of, 712
stability of, 711
structure of, 708
summary of, 721–722
toxicity of, 711–712
physical characteristics of halogenated inhalation anesthetics, 707
sevoflurane, 722–726
adverse effects of, 725
cardiovascular effects of, 724, 725
emergence from, 724
metabolism of, 724
nitrous oxide with, 724
pharmacokinetics of, 722–723
respiratory effects of, 724
stability of, 723
Voltaren, 821
Vomiting. See *Nausea and vomiting.*

Warfarin, for arterial embolism, 132